

## DETECTION OF *SALMONELLA ENTERICA* IN DIFFERENT MATERIALS FROM THE ENVIRONMENT OF PIG HERDS

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Salmonella contamination of pork carcasses as a result of subclinical salmonella infection in pig herds constitutes a menace to human health. Since 1993 there has been a national surveillance system in Denmark with the aim of monitoring and controlling salmonella infections in pig herds (Mousing *et al.*, 1997). Application of the HACCP principles in control of salmonella infection at herd level depends on the possibility of characterizing the bacteriological status of the different sections of the herd in order to define the critical control points of the production. The objective of the present study was to characterize the microbiological status of the environment in pig herds with respect to different types of salmonella infection, and to evaluate the availability of material which is easy to collect and sensitive in the bacteriological examination.

### MATERIALS AND METHODS

A total of 12 pig herds with different levels of salmonella infection was investigated (3 with clinical disease, 6 subclinically infected, 3 without salmonella problems as controls). All herds were visited at least once, and in herds with high prevalence of *S. Typhimurium* 1 or 2 additional visits were made. In herds showing clinical disease, the first visit was carried out within fourteen days after the diagnosis had been made.

From each section of the herds different kinds of material (faecal samples, pen samples (5 x 5 g per 1-2 pen), dust, swabs of equipment and ventilation system, slurry) were collected for microbiological investigation by a method including non-selective preenrichment, selective enrichment in Rappaport Vassiliadis broth followed by subcultivation on brilliant green agar. Isolates were serotyped according to the Kauffmann-White scheme, and isolates of *S. Typhimurium* were furthermore phage typed (Colindale system). A total of 1,140 samples were investigated.

### RESULTS

*Salmonella enterica* was isolated from 245 of the samples (22%) representing 11 of the investigated herds. The isolations were most frequently made from slurry (34%), faecal samples (25%) and pen samples (24%), but occurred in all sorts of material (Table 1).

*S. Typhimurium* was isolated from all herds known to have salmonella problems and from one control herd. The *S. Typhimurium* isolates belonged to 6 different phage types (PT 12, 66, 110, 135, 193 and U288). Only isolates of one phage type were found within each herd. *S. Typhimurium* from one herd was untypable. In two of the *S. Typhimurium* positive herds there were additional isolations of *S. Tennessee* and *S. 4.12:b:-*. In one control

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Table 1. Isolation of *Salmonella enterica* from different materials in pig herds

Material	faeces	pen samples	dust	equipment	ventilation	slurry
No. of samples examined	90	792	77	169	52	50
% <i>S.</i> positive herd	25	24	14	13	12	

Ohio was isolated. In another control herd *Salmonella* was not isolated.

The isolation frequency of *Salmonella* from pen samples varied among the positive herds from 2 to 63%. The highest frequencies in herds with clinical disease. However, one herd showing no clinical disease was highly contaminated with 53% of the pen samples being positive for *S. Typhimurium*. High contamination persisted for up to four months. In most of the subclinically infected herds and in two control herds *Salmonella* was only isolated sporadically. The serotypes isolated differed, however, as *S. Typhimurium* was uncommon among the control herds.

*Salmonella enterica* was isolated from all sections within the herds, and especially among the highly contaminated herds. *Salmonella enterica* was spread all over, independently of where the diseased pigs, if any, were placed. In weakly contaminated, subclinically infected herds, however, *Salmonella enterica* tended to be more frequently isolated from the finisher unit than from other parts of the herd (Table 2).

## DISCUSSION

Pen samples, representing several individuals, have proved a useful material for monitoring the bacteriological status within pig herds. The results reflect the current infection level in a herd with a sensitivity similar to that of examination of individual faeces samples, but collecting pen samples is easier. Other materials from the extra-animal environment were also contaminated with *Salmonella enterica*.

Herds with clinical disease were highly contaminated with *S. Typhimurium* through all sections, and the infection persisted for several months after the clinical disease had disappeared. One of the subclinically infected herds, however, was contaminated at a similar level indicating a very active infection, especially among growers and slaughter pigs. In other subclinically infected herds *Salmonella enterica* was only isolated occasionally indicating chronic and silent infection with only intermittent excretion of bacteria. The environmental contamination may, however, be sufficient to cause the spread of infection to newly introduced pigs because horizontal spread is a major source of infection (Dahl *et al.*, in press).

*Salmonella enterica* was also isolated occasionally from herds which had not been pointed out as "salmonella problem herds". In these herds *S. Typhimurium* was less often isolated than in the other herds, and this might explain why these herds are not pointed out in the surveillance system, as the infections with serotypes other than *Typhimurium* will not always result in a serological response strong enough to be detected in the test system used (Baggesen and Christensen, 1997).

Table 2. Distribution of *Salmonella enterica* contamination in different herd sections (S: dry sow, F: farrowing unit, N: nursery, G: growers unit, F: finisher unit)

Type of infection (No. of herds)	Section: % positive pen samples				
	S	F	N	G	F
Clinical (3)	30	17	27	40	43
Subclinical (active) (1)	31	39	85	74	11
Subclinical (silent) (5)	8	2	6*	0	14
Control (3)	4	0	15	0	4

\* isolates represent only one herd

The present investigation describes the distribution of *Salmonella enterica* in the extra-animal environment. Other investigations have shown that it is possible to rear salmonella free slaughter pigs from infected herds by weaning to a clean environment (Dahl *et al.*, in press). In this connection the present investigation especially underline the importance of a clean environment and points to the need for effective cleaning and disinfection procedures.

#### REFERENCES

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